

MOLECULAR FORMULA DETERMINATION

p. 118 #3 1N 100g

$$m_C = 68.54g \xrightarrow{\% \text{ mass}}$$

$$\eta_C = 5.71$$

$$m_H = 8.63g$$

$$\eta_H = 8.54$$

$$m_O = 22.83g$$

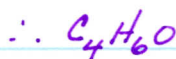
$$\eta_O = 1.43$$

$$C : H : O$$

$$\Rightarrow \frac{5.71}{1.43} : \frac{8.54}{1.43} : \frac{1.43}{1.43}$$

$$4 : 6 : 1$$

EMP. FORM.



$$\begin{aligned} \text{MM of Unknown} &= 140.20 \text{ g/mol} \\ \text{MM of Emp. Form.} &= 70.10 \text{ g/mol} \end{aligned} \xrightarrow{\times 2}$$

\therefore Unknown is $C_8H_{12}O_2$

#4 1N 100g

$$m_C = 76.5g \xrightarrow{\% \text{ mass}}$$

$$\eta_C = 6.37$$

$$m_H = 12.2g$$

$$\eta_H = 12.08$$

$$m_O = 11.3g$$

$$\eta_O = 0.706$$

$$C : H : O$$

$$\Rightarrow \frac{6.37}{0.706} : \frac{12.08}{0.706} : \frac{0.706}{0.706}$$

$$9 : 17 : 1$$

\therefore E.F. is



$$\begin{aligned} \text{MM of Unknown} &= 706.3 \text{ g/mol} \\ \text{MM of E.F.} &= 141.16 \text{ g/mol} \end{aligned} \xrightarrow{\times 5}$$

\therefore Unknown is $C_{45}H_{85}O_5$

#5 In 100g

$$m_K = 26.65g \rightarrow \gamma_K = 0.682$$

$$m_{Cr} = 35.33g \quad \gamma_{Cr} = 0.679$$

$$m_O = 38.02g \quad \gamma_O = 2.38$$

$$K : Cr : O$$

$$\Rightarrow \frac{0.682}{0.679} : \frac{0.679}{0.679} : \frac{2.38}{0.679}$$

$$1 : 1 : 3.5$$

$$2 : 2 : 7 \therefore \text{E.F. is}$$



$$\begin{aligned} \text{MM of unknown} &= 294.20 \text{ g/mol} \\ \text{MM of E.F.} &= 294.20 \text{ g/mol} \end{aligned} \quad \uparrow \times 1$$

\therefore UNKNOWN IS $K_2Cr_2O_7$

#6 In 100g

$$m_C = 74g \rightarrow \gamma_C = 6.16$$

$$m_H = 8.7g \quad \gamma_H = 8.61$$

$$m_N = 17.3g \quad \gamma_N = 1.08$$

$$C : H : N$$

$$\Rightarrow 6.16 : 8.61 : 1.08$$

$$5.8 : 7 : 1$$

Thus E.F. is C_5H_7N

$$\begin{aligned} \text{MM of unknown} &= 162.26 \text{ g/mol} \\ \text{MM of E.F.} &= 81.13 \text{ g/mol} \end{aligned} \quad \uparrow \times 2$$

\therefore UNKNOWN IS $C_{10}H_{14}N_2$

p. 120

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In 100g

$$m_{Na} = 21.9g \rightarrow n_{Na} = 0.952$$

$$m_C = 45.7g \quad n_C = 3.81$$

$$m_H = 1.9g \quad n_H = 1.88$$

$$m_O = 30.5g \quad n_O = 1.91$$

~~$\therefore C_4H_2O_2$~~

Na : C : H : O

$$0.952 : 3.81 : 1.88 : 1.91$$

$$1 : 4 : 2 : 2$$

\therefore E.F. is $NaC_4H_2O_2$

$$\begin{aligned} \text{MM of UNKNOWN} &= 210 \text{ g/mol} \\ \text{" " E.F.} &= 105.1 \text{ g/mol} \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} \times 2$$

\therefore UNKNOWN is $Na_2C_8H_4O_4$

9 In 100g

$$m_C = 49.38g \rightarrow n_C = 4.11$$

$$m_H = 3.55g \quad n_H = 3.51$$

$$m_O = 9.40g \quad n_O = 0.588$$

$$m_S = 37.67g \quad n_S = 1.17$$

C : H : O : S

$$4.11 : 3.51 : 0.588 : 1.17$$

$$7 : 6 : 1 : 2$$

\therefore E.F. = $C_7H_6OS_2$

$$\text{MM of UNKNOWN} = 170.25 \text{ g/mol}$$

$$\text{MM of E.F.} = 170.25 \text{ g/mol}$$

\therefore molecular

formula is $C_7H_6OS_2$